

(40-96) $p < 0.001$ at follow up. Mean preoperative pain score improved from 3.83 (0-10) to 12.83 (5-15) $p < 0.001$ at follow up. Mean preoperative forward flexion improved from 122.22 (60-170) to 162.44 (15-170) $p < 0.001$. 35% (54 patients) had an arthrogram, 65% (100 patients) had an MRI and 0.7% (1 patient) during or after their follow up evaluation. Imaging demonstrated that 92%, 80%, 58% of the Type I, II, III lesions respectively were intact at follow up.

Conclusion: The results of this study indicate that the transosseous equivalent double-row rotator cuff repair (the suture bridge technique) has excellent results at greater than 1 year follow up.

A New Technique to Achieve Arthroscopic Rotator Cuff Repair Using Trans-osseous Fixation Instead of Suture Anchors (SS-03) *Marc Beauchamp, M.D., F.R.C.S.C.*

Introduction: We demonstrate a technique and the preliminary results of arthroscopic rotator cuff repairs performed by means of trans-osseous (bone tunnels) fixation, using newly designed instruments.

Methods: We have designed a curved awl and a curved hollowed hook enabling the making of bone tunnel under arthroscopy, and the visual retrograde passage of sutures through it. After testing it on arthroscopic training lab models, we have proceeded to forty (40) consecutive cases of arthroscopic rotator cuff repair (small and medium size tears). We have assessed the patients at 2,4 and 6 months post-operatively.

Results: We have achieved full repair in 38 of the 40 cases. In the two cases we did not succeed, it was due to bone bridge failure during the tying of the knots related to inappropriate distal entry in the humerus (i.e. less than 10 mm distal to the apex of the greater tuberosity). Both were converted to standard repair using suture anchors. Mean operative time was increased for the first 25 cases as compared with our "normal suture anchor time" (+ 11 minutes), but became normal for the last 15. Clinical results at 6 months were comparable to our regular suture anchor experience. Apart from the two cases mentioned above, we report no complications.

Conclusion: Trans-osseous rotator cuff repair can be safely achieved by arthroscopy. The use of reusable specially designed awl and hollowed curved hook facilitate the passage of the sutures under direct visualization. The bone tunnel should include a minimum of 10 mm of lateral humeral cortex for solidity. This technique provides excellent per operative fixation and clinical results that are comparable to those obtained with suture anchors, but at a substantially reduced cost.

Measurement of Rotator Cuff Tension In Vivo: Single-row vs Double-row Repair (SS-04) *David W. Wang, M.D., Joseph P. Burns, M.D., Mark H. Getelman, M.D.*

Introduction: The merits of single-row vs. double-row rotator cuff repair constructs have been debated in recent years. Some authors suggest that double-row constructs are biomechanically superior and provide restoration of the footprint of the rotator cuff. Others have suggested that the laterally based double row repair places significantly higher tension on the construct compared to a medially based single-row repair. The purpose of this research was to report the difference in rotator cuff tension between medially based articular margin single-row repairs compared to laterally based double-row repairs in vivo.

Methods: Patients with rotator cuff tears undergoing arthroscopic rotator cuff repair at a single institution were identified. After diagnostic arthroscopy, the rotator cuff tear is debrided back to normal, healthy tissue, and adhesions to the bursa or labrum are removed. The tear size is measured in the anterior-posterior and medial-lateral planes using a pre-measured marked suture. A tissue grasper is then placed onto the apex of the tear through the lateral portal. A calibrated digital weigh scale is then attached. The tendon edge is then pulled just lateral to the articular margin, simulating the location of a medially based single row repair, and the tension is recorded. Next, the tendon edge is pulled laterally to the edge of the greater tuberosity, simulating its final location after a double row repair, and the tension is recorded. All measurements are made with the arm abducted 20 degrees, simulating the position of post-operative sling immobilization.

Results: Twenty-one rotator cuff tears were available for measurement. 16 were crescent tears. 3 were L-shaped and 2 were bursal sided partial tears that required completion of the tear. The average AP tear size was 18.1 mm. The average ML tear size was 19.7 mm. The mean cuff tension when the tendon edge was approximated to the articular margin was 0.41 lb. The mean cuff tension when approximated to the lateral greater tuberosity was 2.16 lb. This is a 5.2 fold difference ($p < 0.000001$). Sub-group analysis was done for small (≤ 20 mm ML) vs. large tears (> 20 mm ML) tears. For the smaller tears, the average tension to the articular margin was 0.28 lb. The average tension to the lateral tuberosity was 1.73 lb for a 6.3 fold difference ($p < 0.0005$). For the larger tears, the average tension to the articular margin was 0.63 lb. The average tension to the lateral tuberosity was 2.84 lb. This was a 4.5 fold difference ($p < 0.0005$). When com-

paring the tension at the articular margin between small and large tears (0.28 vs 0.63 lbs), a difference was noted ($p < 0.01$). Significance was also achieved when comparing the tensions at the lateral tuberosity ($p < 0.04$) between small and large tears (1.73 vs. 2.84 lbs).

Conclusion: This study demonstrates a significant 5-fold difference in the amount of tension the rotator cuff tendon experiences under medially-based single and laterally-based double-row constructs at the time of repair. Larger, retracted tears > 2 cm require significantly more tension to reapproximate to both the articular margin and lateral tuberosity.

Clinical and Radiographic Results of Partial Repairs in Irreparable Rotator Cuff Tears: Preliminary Report (SS-05) *Jae Chul Yoo, M.D., Kyoung Hwan Koh, M.D., Kyung Jea Woo, M.D., Min Soo Shon, M.D., Kyung Ho Koo, M.D.*

Introduction: Large to massive rotator cuff tears are challenging conditions in shoulder surgery and frequently it is impossible to repair completely even with the advancement of the knowledge and repair technique. For those irreparable rotator cuff tears, several alternative treatment options can be considered. Among them partial repair (so-called force couple repair) has gained some popularity in that it can lead to pain relief and functional improvement. The purpose of this study was to report the preliminary clinical and radiographic results of arthroscopic force couple repair for the irreparable rotator cuff tears.

Methods: From June 2005 to February 2008, 101 large to massive rotator cuff patients were arthroscopically operated. Among them sixteen cases of force couple repair (posterior cuff repair with or without repair of upper portion of subscapularis) for the irreparable rotator cuff tears were available in evaluation. Clinical assessments were done at final follow-up with pain visual analogue scale (PVAS) and American Shoulder and Elbow Surgeons' (ASES) score. Postoperative acromiohumeral distance and arthritic change were compared with the preoperative plain radiographs.

Results: The mean follow up was 27.3 months (15~46) and the mean age was 66.6 years (57~76). There were 7 male and 9 female patients. PVAS and ASES score was improved from 4.4 (± 2.5) and 39.0 (± 10.8) to 2.1 (± 2.3) and 80.3 (± 16.8) ($p = 0.003$ and 0.002 , respectively). Three patients rated excellent, 9 patients rated good, 3 patients rated fair, and one patient rated poor. Acromiohumeral distance was measured as 6.6 (± 1.7) mm preoperatively and 6.2 (± 1.7) mm postoperatively. There was no statistical difference

($p = 0.387$). Degenerative change by Hamada classification was not progressed postoperatively ($p = 0.201$).

Conclusion: Partial repair for the irreparable rotator cuff tear showed good clinical results and no progression of acromiohumeral distance and degenerative change at mean 2.3 years after surgery.

Arthroscopic Treatment of Rotator Cuff Pathology in Patients with Concurrent Glenohumeral Arthritis (SS-06) *Raymond R. Drabicki, M.D., Larry D. Field, M.D., Felix H. Savoie III, M.D., J. Randall Ramsey, M.D., E. Rhett Hobgood, M.D.*

Introduction: Managing patients who have rotator cuff pathology and glenohumeral arthritis poses a difficult clinical dilemma. The aim of this study was to examine the clinical outcomes of patients undergoing arthroscopic management of rotator cuff pathology with subacromial decompression and rotator cuff repair as well as debridement for glenohumeral arthritis.

Methods: A retrospective review of 55 consecutive patients with clinical and radiographic findings strongly suggestive of rotator cuff pathology as well as with clear radiographic and clinical evidence of glenohumeral joint osteoarthritis was conducted. Surgical treatment included arthroscopic debridement, chondroplasty, and microfracture of grade III and IV humeral and glenoid lesions, subacromial decompression, and rotator cuff repair if warranted. Pain, range of motion, and progression of osteoarthritis on radiographic imaging were evaluated in all patients. A shoulder questionnaire at final follow up was used to assess subjective measures and patient satisfaction. Outcomes were evaluated using ANOVA statistical analyses and post hoc tests.

Results: All 55 consecutive patients with an average age of 64.7 years were evaluated. Chondroplasty and microfracture techniques were employed to address all articular lesions. Arthroscopic rotator cuff repairs were performed in 29 (53%) patients. Average follow up was 38.1 months at which time average forward flexion and external rotation improved from 119 to 144 degrees ($p < 0.038$) and 24 to 40 degrees ($p < 0.043$) respectively. 67% of patients reported mild or no limitations with the use of their shoulder and 44 (80%) reported improvements in pain level. Only 3 (6%) patients reported severe limitations. Two of these patients underwent subsequent shoulder replacement within 1 year after the index procedure.

Conclusion: Often, patients with rotator cuff pathology have concurrent glenohumeral arthritis. Failure of conservative management has often been met with limited options, namely shoulder replacement in this specific